## OUR BOOK SHELF.

*Stones for Building and Decoration.* By George P. Merrill, Curator of Geology in the United States National Museum. (New York: John Wiley and Sons, 1891.)

THIS work deals almost exclusively with the building and ornamental stones of the North American continent, the references to similar rocks in Europe and elsewhere being usually meagre and sometimes disappointing. As an account of the rocks of the United States which are of economic importance as building materials, the work is, however, a very admirable one; and, as might have been expected in a treatise bearing the name of so well-known an authority as Mr. Merrill, the book is replete with valuable information both to the geologist and the architect.

Mr. Merrill gives, in the introduction to his work, an interesting sketch of the gradual substitution of stone for wood as a building material among the early settlers in New England, and then proceeds to sketch the distribution of the different varieties of building stones in the several States and Territories of the Union. The chapters which follow, on the minerals of building stones, and on the physical and chemical characters of the rocks which are employed in construction, are very admirably written; the illustrations of the microscopical structure of building stones, and the remarks on the nature and causes of disintegration in different varieties, being alike excellent.

In classifying building materials, Mr. Merrill very wisely adopts a combination of practical and scientific methods. Among the crystalline and vitreous rocks, he distinguishes, in the first place, those which are simple or made up of one mineral only—namely, steatite and soapstone, serpentine (including the verdantique marbles), gypsum (including alabaster and satin spar), and limestones with dolomites. In dealing with the compound rocks, or those built up of several different minerals, Mr. Merrill adopts the usual petrographical distinction of massive and schistose (or foliated) rocks. The former he divides into the four groups of rocks containing free quartz, rocks without quartz, but containing orthoclase felspar, rocks with plagioclase felspar, and rocks without felspar. The fragmental rocks are divided into the psammites (sandstones, &c.), the pelites (clays, &c.), the volcanic tuffs, and the rocks built up by organisms.

The chapters on the methods of quarrying, working, and testing building stones are especially admirable, and the illustrations of the great quarries of the United States, reproduced from photographs, are of great interest. The remarks on the processes which have been devised for the protection and preservation of building stones, and the tables giving the crushing strength, specific gravity, ratio of absorption, and chemical composition of all the chief varieties of building stone employed in the United States, cannot fail to be of great value to practical men. It would be hard to find a more admirable example of the value of exact scientific knowledge when applied to the treatment of economic questions than is afforded by the work before us.

*Les Champignons.* Par A. Acloque. (Paris: J. B. Baillière et Fils, 1892.)

THE author of this book has found much to interest him in the study of his subject, and he communicates in a clear, pleasant style the leading facts and laws which have been brought to light by mycologists. Having presented in an introductory chapter some general considerations, he proceeds to deal with the subject from the anatomical, the physiological, and the economical points of view. Finally he gives a summary of mycological taxonomy. The book belongs to the "Bibliothèque Scientifique Contemporaine," and is in every way worthy of a place among the other volumes of the series.

*Theory of Heat.* By J. Clerk Maxwell. Tenth Edition. With Corrections and Additions by Lord Rayleigh. (London: Longmans, Green, and Co., 1891.)

THIS book is so well known, and has been of such good service to students, that it is scarcely necessary to do more than note the fact that a tenth edition of it has been issued. Only such corrections and additions have been introduced as seemed, in Lord Rayleigh's judgment, to be really called for. They are in great measure derived from Clerk Maxwell's later writings.

## LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

### The Implications of Science.

PERMIT me, through your columns, to thank Mr. E. T. Dixon for his letter, which appeared in NATURE of December 10, 1891, p. 125, concerning my lecture on the implications of science, and, very briefly, to reply to it.

He is very much mistaken in thinking that I place our knowledge of "the law of contradiction" and of "our own continuous existence" in the same category. I regard them as truths fundamentally distinct. The former is an abstract principle, the latter a particular fact. Since Mr. Dixon merely affirms without arguing, he must permit me to contradict him, and say that the law of contradiction *is* a necessary and *objective* truth—one that does *not* merely express a "verbal convention," and is *not* "of the nature of a definition." It is so objective that Omnipotence itself could not violate it—could not, *e.g.*, cause a creature to have at the same time both four and only three legs. But "our continuous existence" is so far from being a necessary truth that, if an Omnipotent Creator exists, there can be no impossibility in our annihilation. That we cannot be annihilated while we know we are actually existing is, of course, true; but that fact, so far from serving Mr. Dixon's argument, is but an example of the validity of the law of contradiction. We cannot at the same time be both "consciously existing" and "absolutely annihilated." My critic seems to be still in bondage to that subjectivism and nominalism wherein I was so long involved, and whence I only extricated myself slowly and with much trouble.

As to memory, I said that we may, as everybody knows, make mistakes, but that nevertheless we are as certain concerning some parts of the past as of the present. Most assuredly I am *quite* as certain that I read Mr. Dixon's letter as that I am now in the act of replying to it. Our confidence in our memory cannot depend upon induction, because, if we had it not at starting, we could make no induction or enumeration whatever.

My "implications of science" are truths, and not "purely verbal assertions," but I never affirmed any "peculiar certainty" for "mathematical conclusions." Helmholtz has never shown, to my knowledge, that two straight lines could ever inclose a space. Of course, if his supposed "dwellers on a sphere" chose, as Mr. Dixon says, to apply that term to what are *not* straight lines, different conclusions would follow. No one denies that two *curved* lines can be conceived of as inclosing a space.

Similarly, if Mr. Dixon's inhabitants of the Dog Star chose, as he again says, "to define four as $1 + 1 + 1$," then for *them* two and two would not be four. But who was ever so absurd as to suppose they would be? If any persons choose to give to the term "an angle" the signification we express by the words "a mutton chop," then certainly our conception of a triangle would not apply; for three such angles would not be equal to two right angles.

Mr. Dixon is good enough to instruct us that "the law of contradiction never tells us whether anything is or is not." But what man out of Bedlam would suppose that a statement of an abstract general law would inform us about a particular concrete thing? On the other hand, the law of contradiction does not tell us, and never by any possibility could tell us, "that the terms 'is' and 'is not' are not applicable to the same thing"—though

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by applying that abstract universal and necessary law to such things as "terms," we see that a term applicable to anything cannot at the same time be the very opposite.

Mr. Dixon says: "If anyone chooses to say a thing both 'is' and 'is not,' there is no law against his doing so, only if he does so he is not talking the Queen's English." But by so doing he breaks the law of reason, if not the law of the land; and, indeed, to act on such a principle when on oath in a court of law might, after all, have inconvenient consequences.

My critic is obliging enough to say in plain and simple terms: "Dr. Mivart is wrong in speaking of the objective absolute validity of the law of contradiction." To this I might content myself by replying: "*Quod gratis asseritur gratis negatur*"! But let us avoid the use of the terms "is" and "is not": they are not necessary for my purpose. Does Mr. Dixon really doubt whether, if he had lost one eye, he would still remain, after that loss, in the very same condition he was in before? If anyone does not see the objective impossibility of such a thing *everywhere* and *everywhen—i.e.* if he does not apprehend the application of the law of contradiction—then he either does not understand the question, or his mental condition is pathological. The implications of science are implied. Men may pretend to doubt them, their own existence, or the objectivity of mathematical truths. But their practice shows their unfailing confidence in them on each occasion as it arises—as when cheated by false accounts, personally injured, or engaged in scientific research. When we enter the laboratory, we leave these follies outside. ST. GEORGE MIVART.

Hurstcote, December 22, 1891.

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WILL you allow me to say a few words in reference to four points in Mr. E. T. Dixon's indictment (NATURE, December 10, p. 125) of Mr. St. George Mivart?

(1) Mr. Dixon asserts that the law of contradiction "is not a *necessary* truth at all, it only expresses a verbal convention"—it "never tells us whether anything 'is' or 'is not.' It only informs us that the terms 'is' and 'is not' are not applicable to the same thing." But though it may be only a "verbal convention" that in "the Queen's English" *not* is the sign of negation, it is not a mere verbal convention that if *a* signifies the negation of A (whatever A may stand for), then A and *a* "are not applicable to the same thing"—as the law of contradiction asserts, and as Mr. Dixon himself allows. A highly abstract law that is concerned with the relations of propositions cannot, of course, tell us whether any particular thing exists or not—but then no one has ever expected that it should; and moreover, assertions (or denials) of the "existence" of particular objects are not the only "real" propositions (Mr. Dixon appears to be misled here partly by the ambiguity of *is*).

(2) Mr. Dixon says that the law of gravitation—like other laws suggested by particular experiences—depends ultimately upon induction *per enumerationen simplicem*; that is, upon an inference of the form *This A is X, that A is X, &c.* (= *Some A's are X*), ∴ *All A's are X* (for we can make nothing better out of an induction by simple enumeration). But this inference is merely an immediate inference, and moreover an illegitimate one; hence, according to Mr. Dixon's view, inductions have no logical justification whatever.

(3) Further, Mr. Dixon asserts that "the supposed peculiar certainty of mathematical conclusions is solely due to the fact that they are truisms," or "purely verbal assertions,"—by which I understand him to mean definitions. In answer to this I should maintain that the peculiar certainty of mathematical propositions, and the fact that here, by help of a single instance, we unhesitatingly conclude to the universal, are (as I have observed elsewhere) explicable by "the consideration that we here *see* at once the connection, which in other cases we *believe* on grounds very different from a perception of self-evident interdependence of attributes. When the equality of the interior angles of any one triangle to two right angles has been demonstrated to us, we infer without a moment's doubt that the same relation of equality may be asserted of the interior angles of *every* triangle; and this because we have *seen* that with the attributes signified by 'the interior angles of a triangle' there is bound up the attribute of 'being equal to two right angles.' We *believe* that, if a certain amount of arsenic has on some occasions produced death, it will always produce death, on the ground that the apparent likenesses are connected with unapparent likenesses; but we have not *seen* in this case (as we have in the case of the triangle) that there is a self-evident interdependence. And here we see why it is that, in the case of mathematical inductions, we do not need to use Mill's 'Inductive Methods.'"

(4) When Mr. Dixon goes on to say that, "*if* the inhabitants of the Dog Star defined 'twice,' 'two,' and 'four' as we do, then 'twice two' would be to them 'four'; but to say that it was so could only give verbal information," he may be refuted out of his own mouth. For he goes on to remark that, "if the people in the Dog Star chose to define four as $1+1+1$, the so-called 'necessary truth' would not even be true!"; thus showing clearly that it is the facts signified, and not the words which signify them, that we are concerned with. According to Mr. Dixon, it would be (for me) a necessary truth that I have a headache, or am writing with a lead-pencil; while mathematical truths, in as far as "real," are obtained by induction, and are therefore not necessary. I hold, on the contrary, that mathematical truths, though obtained by induction, are "necessary"—that is, true under all circumstances—and that it is only by a confusion between "necessary" and "certain" that a statement of the apprehension of present fact can be called a "necessary truth." E. E. C. JONES.

Cambridge, December 14, 1891.

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### Supernumerary Rainbows observed in the Orkneys.

I INCLOSE a letter just received. The writer has charge of the anemometer formerly kept by the late Dr. Clouston. Dr. Clouston first drew my attention to the extraordinary bow seen at Kirkwall in 1871. My note is in the Quarterly Journal of the Meteorological Society, vol. i. p. 237.

ROBERT H. SCOTT.

Meteorological Office, 63 Victoria Street, S.W.,
December 31, 1891.

*Deerness Public School, Kirkwall, December* 28, 1891.

SIR,—On reading your very interesting work on "Elementary Meteorology," I find, on p. 201, reference made to "an extraordinary bow" which appeared at Kirkwall, November 13, 1871, which you explain by the reflection of the sun's rays from a water surface.

On Saturday, the 26th inst., at 3.20, when the sun was on the horizon, I saw a very distinct rainbow; there was no trace whatever of the secondary bow, but between where it ought to have been and the primary one there were several patches of what are called "supernumerary" bows. The only colour I saw distinctly was the red.

This lasted for about four minutes, when, finally, a second bow appeared just inside the primary, with the colours arranged as in the primary—not reversed, as the secondary. The space between the violet of the primary and this one was almost *nil.* The red next the violet of the primary was about as distinct as that of the primary. The orange and yellow were distinct also, but the others could hardly be seen. This was, no doubt, owing to the fading light of day, and to the dark colour of the clouds in the north-east, where the bows appeared. These lasted distinctly and complete for about one minute. The bows formed, as is well known, half a circle. The sun was setting behind land at the time, and the wind was blowing at the rate of forty-five miles, so that there could be no water reflection.

If I am not troubling you too much, would you kindly say if this is unusual, and if caused by the "interference" of rays?

Yours respectfully,
(Signed) M. SPENCE.

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### Aurora Borealis.

A FINE display of aurora was observed here on the evening of January 4. A faint northern glow was seen at 8.30, which quickly grew in brightness, and at 8.45, streamers in great quantity were visible. At 9 these became tinted with glowing red on their upper portions. After exhibiting lively motions for a quarter of an hour or so, the phenomenon settled down into a brilliant and steady arch of light, red on the outside and white within, resting on what appeared to be a bank of dark cloud. By eye estimate this arch would extend about 90 along the horizon, its apex over the north-north-west from 25° to 30° in height. The glow was still visible at 10 p.m., though considerably diminished in intensity. During the whole of the day a dry and frosty north-west wind prevailed, and the temperature at 10 p.m. was 28°. J. LOVEL.

Driffield, East Yorkshire, January 5.

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